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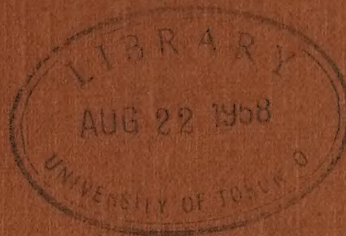
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HYDRO-ELECTRIC INQUIRY COMMISSION

ENGINEERING DATA

THE QUEENSTON-CHIPPAWA POWER DEVELOPMENT

CHAPTER "L"—EVOLUTION OF THE DEVELOPMENT

WALTER J. FRANCIS & COMPANY

CONSULTING ENGINEERS



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Chapter I.

EVOLUTION OF THE DEVELOPMENT

Walter J. Francis.

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When the first studies were made of the International Rapids Development with the intention of utilizing the maximum available head between Lake Erie and Lake Ontario, the estimated surplus of water under the terms of the International Treaty was considered by the engineers of the Hydro-Electric Power Commission to be 10,000 cubic feet per second. To this figure they added an amount to allow for the possible flow from the Holland River, and the preliminary designs were therefore based on a flow of 8,500 cubic feet per second. With this quantity in mind, the engineers of the Hydro-Electric Power Commission developed a canal design with a width of 42 feet and a depth of water of 21 feet. The sides of this proposed canal were to be channelled, and the floor was to be paved with concrete. A typical cross-section of this design such as would apply to the greater part of the southerly rock section of the canal, is shown in diagram "A" on the drawing included herewith as page L-2. This design was adhered to during all the preliminary studies, and estimates made in 1913 and 1914. At the time these preliminary designs for the canal were being prepared a study was also made for the proposed power house. The drawing included herewith as page L-3 shows a cross-section of the Screen House, Trans-

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EVOLUTION OF
THE CANAL SECTION
L. J. Francis
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Chapter L.

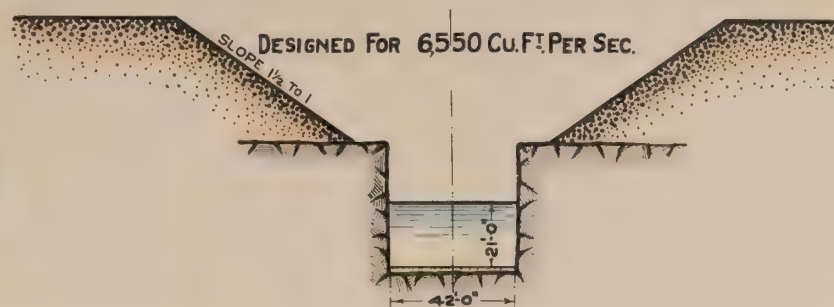
EVOLUTION OF THE DEVELOPMENT.

Walter J. Francis

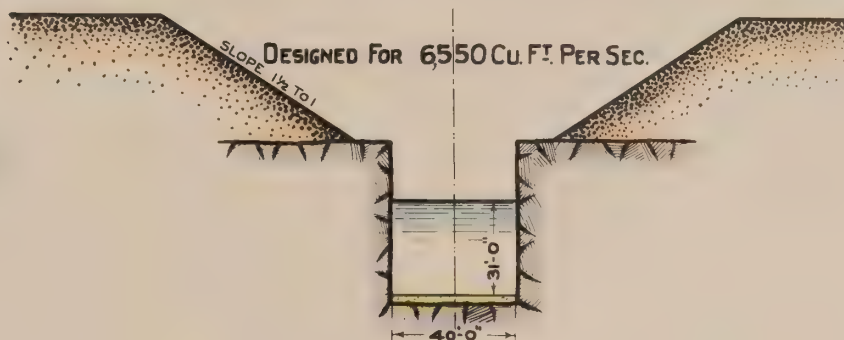
When the first studies were made of the Queenston-Chippawa Power Development with the intention of utilizing the maximum available head between Lake Erie and Lake Ontario, the estimated surplus of water under the terms of the International Treaty was considered by the engineers of the Hydro-Electric Power Commission to be 4,500 cubic feet per second. To this figure they added an amount to allow for the possible flow from the Welland River, and the preliminary designs were therefore based on a flow of 4,550 cubic feet per second. With this quantity in mind, the engineers of the Hydro-Electric Power Commission developed a canal design with a width of 42 feet and a depth of water of 21 feet. The sides of this proposed canal were to be channelled, and the floor was to be paved with concrete. A typical cross-section of this design such as would apply to the greater part of the southerly rock section of the canal, is shown in diagram "A" on the drawing included herewith as page L-2. This design was adhered to during all the preliminary studies, and estimates made in 1915 and 1916. At the time these preliminary designs for the canal were being prepared a study was also made for the proposed power house. The drawing included herewith as page L-3 shows a cross-section of the Screen House, Trans-

When the first studies were made in the early 1930's, the only method of irrigation was by flood. This method was not only wasteful but also caused much damage to the land. The first step was to develop a system of canals. This was done by the U.S. Army Corps of Engineers. They built a series of canals that would carry the water from the river to the fields. This was a great improvement over the flood method. The next step was to develop a system of levees. These were built to prevent the water from flooding the fields. This was also a great improvement. The final step was to develop a system of pumps. These were built to pump the water from the river to the fields. This was the most expensive step, but it was also the most effective. Today, the irrigation system in the Sacramento-San Joaquin River Delta is one of the most advanced in the world. It has been able to provide water to millions of acres of land, and it has also helped to prevent flooding. The system is a testament to the ingenuity and hard work of the people who built it.

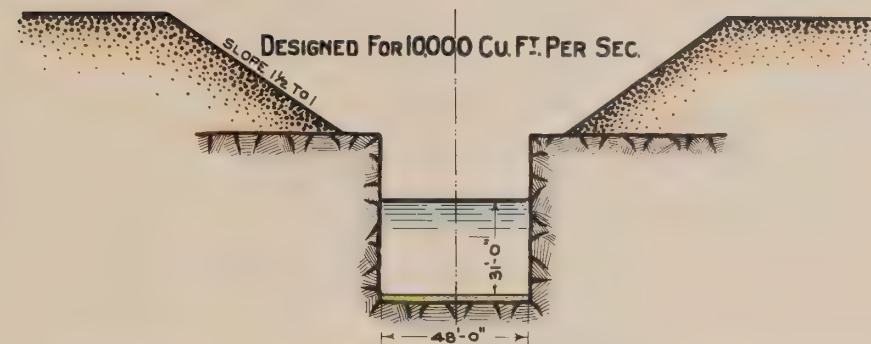
A



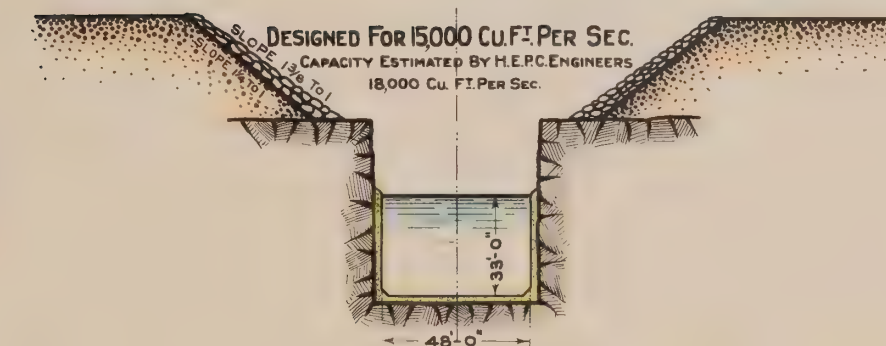
B



C



D



NOTE:-

THE ABOVE CROSS SECTIONS APPLY AT A STATION IN THE CENTER OF THE SOUTHERLY ROCK SECTION. AND ARE TYPICAL FOR THE CANAL EXCAVATED IN ROCK



Scale of Feet

HYDRO-ELECTRIC INQUIRY COMMISSION

W. D. GREGORY - CHAIRMAN

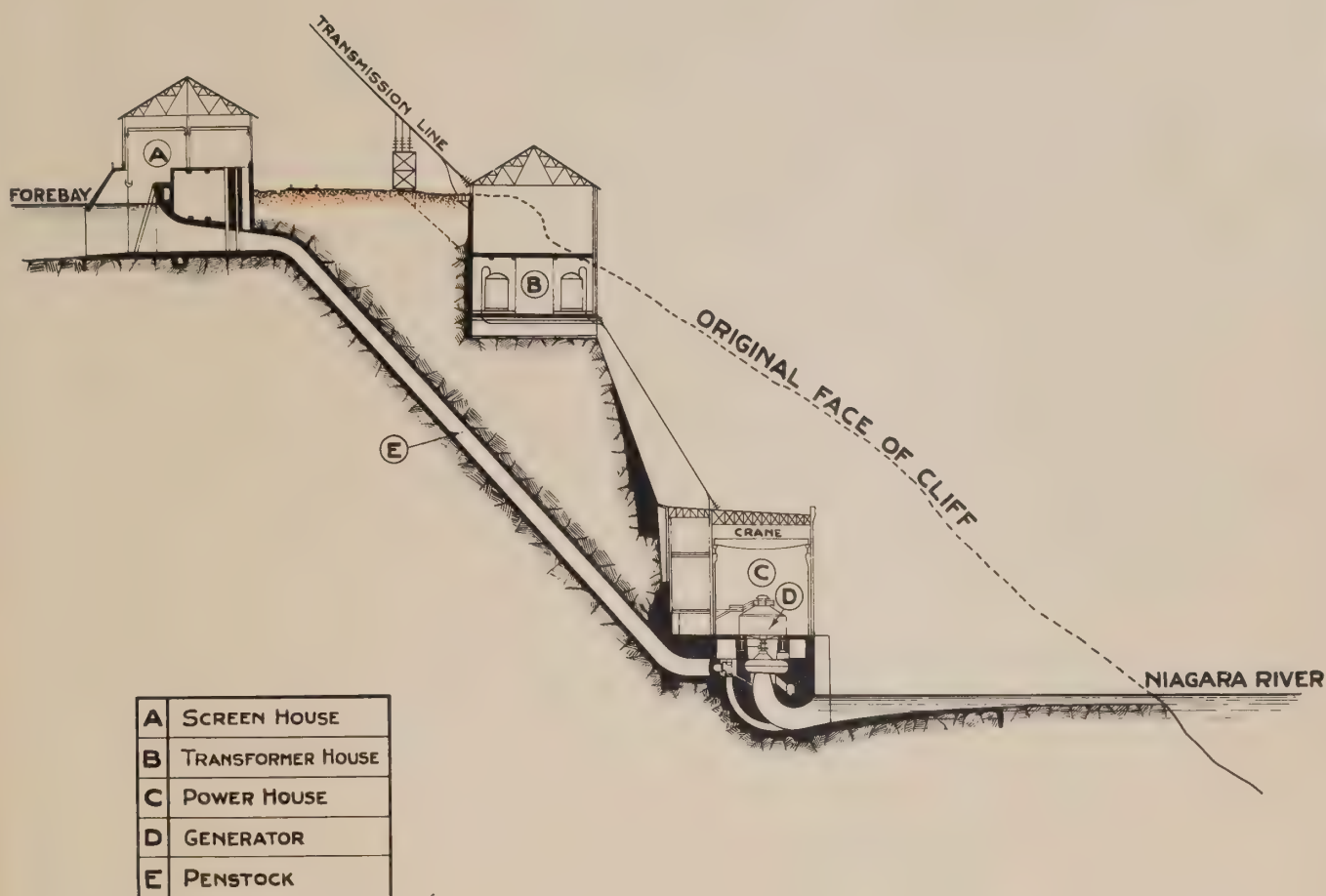
QUEENSTON-CHIPPAWA POWER DEVELOPMENT

EVOLUTION OF THE CANAL SECTION

Scale as Indicated

Toronto, July 6th 1922 Made by *W.D.G.* Checked by *W.J.F.*

WALTER J. FRANCIS, C.E.,
CONSULTING ENGINEER



AS PROPOSED JUNE 1915

0 10 20 30 40 50 60 70 80 90 100 150 200

Scale of Feet

HYDRO-ELECTRIC INQUIRY COMMISSION
 W. D. GREGORY - CHAIRMAN
 QUEENSTON-CHIPPAWA POWER DEVELOPMENT
STUDY OF PROJECTED POWER HOUSE
JUNE 1915
 Scale as Indicated
 Toronto, June 9th 1922 Made by *CMD* Checked by *JCF*
WALTER J. FRANCIS, C.E.,
 CONSULTING ENGINEER

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former House and Power House, together with the type of Penstock, as then contemplated.

In February, 1917, Mr. E. D. Johnson made his first report outlining the studies he had made in connection with the capacity of the canal as designed by the engineers of the Hydro-Electric Power Commission. Mr. Johnson recommended changing the shape of the cross-section of the canal, and as a result the width was changed from 42 feet to 40 feet, and the depth of water was increased from 21 feet to 31 feet. His reasons for making this recommendation were first, that the hydraulic losses in such a canal would be somewhat less than in the design submitted to him for consideration; and second, that the excavating machinery could be more efficiently used in his proposed cross-section. A typical cross-section, as adopted following the recommendations of Mr. Johnson, is shown in diagram "B" on the drawing included herewith as page L-2.

Early in 1917 the possibility of obtaining control of the Ontario Power Company's plant is stated to have led to the decision to increase the canal capacity. A flow of 10,000 cubic feet per second corresponding to an output at the power house of 300,000 horse power, was then adopted. It was considered by the engineers of the Hydro-Electric Power Commission that with the Ontario Power Company's plant under their control, it would be desirable to withdraw some of the water used at that plant and utilize it under greater efficiency in the Queenston-Chippawa plant. For the capacity of 10,000 cubic feet per second, a canal was designed with a width of 48 feet and a depth of

water of 31 feet. The sides were to be channelled and the bottom was to be paved with concrete. A typical cross-section of this design of the canal is shown in diagram "C" on the drawing included herewith as page L-2.

Following further studies of the hydraulic characteristics of the canal with particular reference to its capacity, it was decided late in the year 1917 to increase the depth of the rock-cut so as to provide 33 feet of water instead of 31 feet as heretofore contemplated, still retaining the flow at 10,000 cubic feet per second.

Early in the year 1918 it is stated that the increase in demand for power led the engineers of the Hydro-Electric Power Commission to carry out further studies with the object of providing a canal with a larger capacity than that of any of the previous designs. After consultation with Mr. Johnson, they concluded that it would be possible to provide for a flow of 15,000 cubic feet per second, the equivalent of an output of 450,000 horse power, with comparatively little increase in the cost of the canal. The additional flow was to be obtained by improving the hydraulic characteristics of the canal rather than by increasing its cross-sectional area. To this end a concrete lining was substituted for the channelled rock sides, leaving the neat dimension of the canal at 48 feet wide and with 33 feet of water. Diagram "D" on the drawing included herewith as page L-2 shows the type of section ultimately adopted and constructed.

Upon the canal being put into operation, the engineers of the Hydro-Electric Power Commission were enabled to make further detailed studies of the behaviour of the water with particular reference to such elements of

1. The first of these is the fact that the Commission has not yet received any information from the Government of the United States regarding the activities of the Committee for the Liberation of the Americas (CLA) in the United States. The Commission is therefore unable to determine whether the CLA is active in the United States or not.

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Under the same being put into operation, the condition of the system is maintained as the same.

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their calculation as heretofore could only be determined on a theoretical basis, and they have now calculated that the finished canal will in all probability pass 18,000 cubic feet per second, giving an output of about 540,000 horse power.

Walter J. Francis
Consulting Engineer.

Toronto, July 20th, 1922.

COPY

(1961)

These children are born to a family and are determined on a biological basis, and they are not determined on a biological basis. The children are born to a family and are determined on a biological basis. The children are born to a family and are determined on a biological basis. The children are born to a family and are determined on a biological basis.

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